c) Using Divergence Theorem (Gauss's Theorem) compute $\iint_S \underline{F} \cdot \underline{n}\, ds$ where, $\underline{F}(x, y, z) = (x + y + z)\underline{i} + (x + 2y + 4z)\underline{j} + (x - 3y + 9z)\underline{k}$, S is the surface of unit sphere $x^2 + y^2 + z^2 = 1$ and $\underline{n}$ is the unit vector normal to ds.

4)

If $\underline{A} = (x^2 - y^2)\underline{i} + 2xy\,\underline{j}$

a) Find $\underline{\nabla} \times \underline{A}$

b) Evaluate $\iint_S (\underline{\nabla} \times \underline{A}) \cdot \underline{ds}$ over a rectangular surface in the xy plane bounded by $x = 0$, $x = a$ $y = 0$ and $y = b$

c) Evaluate $\oint_c \underline{A} \cdot \underline{dr}$ around above rectangle and verify stoke's theorem.

3. (a) Verify Green's Theorem in the plane for

$$\oint_C (xy + y^2)dx + x^2 dy$$

where the curve C is the boundary of the region bounded by $y = x$ and $y = x^2$.

(b) Use Divergence Theorem to evaluate the integral

$$\iint_S \left[(\frac{1}{2}x^2 + \exp(\cos zy))\underline{i} + (yx + \ln |z|)\underline{j} + (\tan xy)\underline{k} \right] \cdot d\vec{S}$$

where S is a closed surface bounded by $y = 0, z = 0, z = 1 - x^2$, and $y = 2 - z$.

(b) Use Stoke's Theorem to evaluate the line integral

$$\oint_C (z^2 - y^2)dx + (x^2 - z^2)dy + (y^2 - x^2)dz$$

where the curve C is formed by intersection of the paraboloid $z = 5 - x^2 - y^2$ with the plane $x + y + z = 1$.